

UNITED STATES PATENT OFFICE.

HERBERT N. MCCOY, OF CHICAGO, ILLINOIS.

METHOD OF TREATING RADIO-ACTIVE BARIUM COMPOUNDS.

1,103,600.

Specification of Letters Patent.

Patented July 14, 1914.

No Drawing.

Application filed March 27, 1914. Serial No. 827,667.

To all whom it may concern:

Be it known that I, HERBERT N. MCCOY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of Treating Radio-Active Barium Compounds, of which the following is a specification.

This invention relates to methods of treating barium compounds containing radio-active substances for the purpose of separating or concentrating the radio-active bodies therein.

I have discovered that radium hydroxid is more soluble in cold water, as well as in cold solutions of caustic alkalis, than is barium hydroxid and may, therefore, under proper conditions, be concentrated in solution by fractional recrystallization or fractional precipitation of the mixed hydroxids. This may be accomplished either by concentrating the solutions containing the mixed hydroxids, with proper cooling, in such manner as to secure a fractional recrystallization: or it may be accomplished by adding to the aqueous solution of the mixed hydroxids a precipitant for such hydroxids, preferably a strong solution of caustic soda or caustic potash. The radio-active substances mesothorium-one and thorium-X behave chemically like radium and may be concentrated in like manner.

It is well known that radium is very similar in its chemical properties to barium; and the best method heretofore known for effecting a separation of the two elements, or a concentration of the radium-content of the barium, depends upon a long series of fractional crystallizations of certain salts, notably the chlorids or bromids. When the mixed chlorids are fractionally crystallized from water, if one-half of the salt is permitted to crystallize out, it is found to contain about 65 per cent. of the radium, or, in other words, 1.3 per cent. of the radium for each one per cent. of the barium in the original chlorids. On the other hand, the concentration of the hydroxids by fractional crystallization, as hereinafter described according to method I, permits the separation of about 35 per cent. of the radium with five per cent. of the barium, or seven per cent. of the radium for each one

per cent. of the barium; and method II, hereinafter described, involving the precipitation of the mixed hydroxids by addition of fixed alkali hydroxids, permits the separation of about 32 per cent. of the radium with two per cent. of the barium, or sixteen per cent. of the radium for each one per cent. of the barium. These methods are, therefore, from five to twelve times as effective as the fractional recrystallization of the chlorids.

Method I is as follows:—

(1) The barium chlorid or other soluble barium salt, containing radium, with or without other radio-active substances, as obtained by the treatment of radium-bearing minerals, is dissolved in water and the hot or cold solution is mixed with an excess of a solution of sodium hydroxid or other caustic alkali, the concentrations of the solutions being sufficient to cause the precipitation of the larger part of the barium as hydroxid when the solution is cold.

(2) The barium hydroxid crystals are then separated by filtration or otherwise from the solution, which contains most of the sodium chlorid formed, together with a small proportion of the barium. The barium which remains in solution is much richer in radium than that which is deposited in the form of crystals: for example, when five per cent. of the barium is left in the solution and 95 per cent. in the crystals, the solution contains approximately 35 per cent. of the radium, and the crystals approximately 65 per cent.

(3) The radium-bearing barium hydroxid crystals obtained according to (1) and (2) are now dissolved in hot or boiling water, in which they are very soluble, and the solution is cooled to normal temperature, or better to zero centigrade. A large part of the barium hydroxid crystallizes out, and again there occurs a great enrichment in radium of the barium remaining in the solution.

(4) The barium hydroxid crystals are again separated and dissolved in hot water, and the process above described is repeated as often as may be desired.

(5) The solutions containing the barium enriched in radium are further concentrated by the fractional crystallization of